

## **Update on diagnostic imaging in elbow disease.**

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Ugent

Elbow dysplasia (ED) is characterized by varying degrees of elbow incongruity, bony fragments (bone chips), and ultimately, severe arthrotic change. The term was introduced to describe generalized osteoarthritis (arthrosis) of the elbow joint in which the anconeal process may be ununited (UAP), the medial coronoid of the ulna may be fragmented (FCP), and osteochondrosis of the humeral condyle (OCD) may be present. These three aetiologies resulting in ED can be present individually, but it is important to note that there can be considerable overlapping in their presence. In diagnosing ED there are two different issues: there is the need for selecting ED free breeding stock and there is the diagnosis of the condition in the individual patient presented for forelimb lameness. For selection purposes, most of the time the secondary degenerative joint (DJD) changes are scrutinised by means of radiographs and mostly the individuals are not suffering lameness. For the individual patient the early diagnosis of the primary lesion is very important because an early treatment guarantees a better prognosis.

The diagnosis of elbow dysplasia in lame dogs is made from a combination of clinical signs, palpation (manipulation) of the joints, and medical imaging. A wide range of imaging options is now available but the “perfect” imaging protocol does not exist because each modality has its strengths and limitations. Economic considerations will also have to be taken into account.

In case where the clinical examination is not providing a clear localisation or in case of uncertain radiographic findings, scintigraphy is a useful technique to localise the cause of lameness. Although it is very sensitive, it is not very specific and the spatial resolution offered, is not well enough to specify anatomic structures. Recently a micro-single photon emission tomography ( $\mu$ -SPECT) technique has been described. HiSPECT has a much higher resolution and allows better differentiation of the anatomical areas in the elbow joint. A major drawback to joint imaging by scintigraphy is the normal uptake at the end of long bones, especially in immature animals. In some instances it is difficult to determine whether a difference in counts between two joints represents a meaningful finding. Comparison of bilateral images, acquired over the same time, and quantitative analysis of joint images by computer can provide diagnostic guidelines.

Radiography is still the standard technique for diagnosing elbow disorders in the dog. It is readily available, cost effective and has excellent spatial resolution. Correct radiographic technique is critical for making the diagnosis and multiple views should be taken, and if ED is evident, radiographs of the other elbow are appropriate given the possibility of this problem occurring in both elbows. Three recommended views are a mediolateral, flexed and extended view and an oblique craniomedial-caudolateral view (for better evaluation of the medial elbow compartment). UAP is easily detected with radiographs and in most cases, a diagnosis of OCD can be made with radiographs as well, although a distinction with “kissing lesions” is not always possible. FCP can be diagnosed with radiographs, but can be a challenge in many cases. The problem is that the coronoid process is a relatively small piece of bone that on the radiographic views is superimposed on the other bony structures within the elbow. Given that superimposition, if the lesion is small, it may be difficult, if not impossible, to see. In many of the cases in which the coronoid process cannot be visualized there will be bony changes in other areas of the joint that will strongly suggest FCP. Sclerosis (increased bone density) of the ulnar notch is mostly evident. Unfortunately, the radiographic findings may not be conclusive and in the majority of cases, these lesions can only be indirectly diagnosed by the appearance of secondary osteophytes. These osteophytes are signs of a secondary DJD and they do not appear until the dog is about seven to eight months old. The ideal situation, however, would be that FCP and/or OCD within the elbow joint could be directly diagnosed before the radiographic appearance of DJD changes, being signs of joint damage. For these reasons, imaging techniques that provide direct visualisation of the medial coronoid process

and other joint structures would improve the accuracy of preoperative diagnosis of FCP and would contribute to the early diagnosis of this condition.

Radiographs will reveal incongruity of the joint if the step is large enough.

If the information from the radiographs is equivocal, CT scan can typically help significantly in establishing a firm diagnosis. Abnormalities in the area of the medial coronoid process include: fragmentation (displaced or non-displaced), fissure, abnormal shape, sclerosis, osteophytes, and lucencies. In the area of the medial humeral condyle sclerosis, lucency, and/or flattening can be evaluated and a differential diagnosis between kissing lesions and real OCD lesions can be made. All these abnormalities can be diagnosed on the transverse and reconstructed images. In several cases CT findings, like fissures at medial coronoid process and subchondral lucencies at medial humeral condyle, were useful for decision making in the arthroscopic treatment of these lesions. Ununited anconeal process with or without humeroulnar incongruity can be appreciated and the incidence of incongruities of the humeroradial, humeroulnar, and/or radioulnar joints can be accurately appreciated. On transverse CT slices, at the level of the trochlear notch of the ulna and the humerus, the fitting of the joint space can be noticed. On the reconstructions in the sagittal and dorsal plane, at the level of the trochlea humeri and the lateral compartment the incidence of a step between the ulna and radial head, the shape of the trochlear notch and the fitting of the humeral condyle in the trochlear notch can be evaluated.

MRI has limitations for imaging the canine elbow based on the relatively small size of the joint and complex articulations in conjunction with the thin articular cartilage surfaces of the humerus, radius, and ulna. These limitations depend also of the field strength of the MR device. All MRI planes, dorsal, sagittal, and axial/transverse, are potentially useful for diagnosis of elbow disorders. This technique offers a great visualisation of the soft tissues around the elbow joint and in cases of pathology within the flexor tendons its application can be very useful. The incidence of subchondral bone pathology and oedema can be diagnosed.

Ultrasound (US) is a potential valuable imaging technique of the musculoskeletal system in small animals. Linear transducers with frequencies higher than 7.5 MHz are used because of their flat application surface and high resolution power. Accurate examination of joints requires substantial ultrasonographic experience and a standardised examination procedure. In most of the joints even small amounts of fluid accumulation (hypo- to anechoic) can be easily demonstrated in the area of the joint pouches. Although a thorough US study of the normal elbow joint has been conducted US is only of limited use in the diagnosis of a fragmented coronoid process. Only large displaced fragments can be diagnosed with certainty. Also US is helpful in diagnosing flexor tendon pathology.

### **Suggested reading:**

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